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Abstract:	Basic Psychological Needs Theory is limited by variable-centered studies focused on linear relationships between perceived needs-supportive/controlling coach behaviours. Therefore, Latent Profile Analysis (LPA) was used to determine if heterogenous profiles emerged from the interactive effects of needs-supportive and controlling coach behaviors, and subsequent association with sports-specific mental health outcomes (i.e., burnout and subjective vitality). A total of 685 athletes took part (age = 23.39, 71% = male), and LPA revealed five novel, diverse profiles, labelled as; 'Supportive-Developmental', 'Needs-Indifferent', 'Overly Critical', 'Harsh-Controlling' and 'Distant-Controlling' coaches. Profiles predicted significant mental health variance (adjusted R2=.15 to .24), wherein the 'Supportive-Developmental' profile scored most favourably on 90% of outcomes. Largest mean differences were observed against the 'Harsh-Controlling' (n=5), 'Overly Critical' (n=3) and 'Distant Controlling'(n=2) profiles. Overall, LPA revealed substantial nuance in athletes' social contexts, predicting variance in mental health. Needs-supportive interventions are needed for 'Overly Critical', 'Harsh Controlling' and 'Distant Controlling' athlete profiles.

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1.1 Background

A two-continua model (Keyes, 2005) and sport-sensitive definition (Breslin et al., 2020) outlines that mental health is not merely the absence of ill-being (e.g., emotional difficulties), but a state of well-being in which athletes realize their purpose and potential, can cope with competitive sport demands and life stressors, act autonomously, make a contribution to their community, and seek support. Recent consensus statements (Schinke, Stambulova, Si & Moore, 2018; Moesch et al., 2018; Reardon et al., 2019; Breslin et al., 2019) outline that competitive sport can sometimes hinder athletes' mental health due to the unique stressors encountered. For example, performance expectations (e.g., playing through injury, intense physical training), personal matters (e.g., constrained friendship or family life), and organisational issues (e.g., travel, finance) manifest in both elite (Rice et al., 2016), and non-elite athletes (Breslin, Shannon, Haughey, Donnelly & Leavey, 2017). As such, athletes are as likely, and sometimes ~~,~~ during injury or transition, more likely than non-athletes to struggle with mental illnesses including anxiety and depression (Rice et al., 2016; Beltz, Kleinhart, Ohlert, Rau & Allroggen, 2018; Foskett & Longstaff, 2018; Reardon et al., 2019). Contrastingly however, sporting participation can foster meaningful social connections and psychological well-being, be a source of health-enhancing physical activity, and allow for the delivery of awareness messages conducive to mental well-being (Breslin & Leavey, 2019). Therefore, sport can potentially influence adaptive and maladaptive markers of athlete mental health (Breslin et al., 2020).

There are global (i.e., day-to-day), contextual (e.g., within sport) and situational (i.e., here and now) measurement levels to mental health (Vallerand, 1997). Couched within a eudemonic and hedonic perspective (Ryan & Deci, 2008), ~~sport-based~~ subjective vitality is defined as feelings of positive energy towards oneself in sport (Adie, Duda & Ntoumanis, 2008), and represents a sports-specific marker of well-being linked to sports enjoyment, autonomous motivation and positive affect (Adie, Duda & Ntoumanis, 2008; Quested et al., 2013; Li, Wang & Kee, 2013). Conversely, athlete burnout can be conceptualised a sports-specific marker of ill-being (Gustafsson, Madigan & Lundkvist, 2016; Reardon et al., 2019), defined as a negative psychological syndrome that occurs over time (Radeake, 1997), and is associated with depressed mood, injury and sport withdrawal (Madigan et al., 2019).

Although conceptual debate on burnout continues (Gerber et al., 2018), it is largely agreed that athlete burnout is represented by three persistent symptoms -; (i) emotional and physical exhaustion, (ii) a reduced sense of accomplishment, and (iii) the development of a cynical attitude towards the once favoured sport (Gerber et al., 2018). It is well established that the sporting social environment can play a significant positive and negative role in athlete well-being, and the aetiology of burnout symptomology (Lundqvist, 2011). To effectively understand how sporting environments impact upon such athlete mental health outcomes, studies and interventions based on sound theoretical foundations are required (Breslin et al., 2017; Breslin and Leavey, 2019).

Theorists postulate psychosocial determinants and mediating factors that directly or indirectly affect athlete mental health outcomes (Hagger & Weed, 2019), and research has established that sporting social environments can play a significant positive and negative role in athlete well-being, and the aetiology of burnout symptomology (Lundqvist, 2011). One theory that has received empirical support for the prediction of both positive and negative facets of athletes' mental health is Self-Determination Theory (SDT; Ryan & Deci, 2000). SDT is a meta-theory of human behaviour and health, encompassing several mini-theories that are unified by the position that humans have three innate psychological needs essential to mental health (Ryan & Deci, 2017). Specifically, within Basic Psychological Needs Theory (BPNT; Ryan & Deci, 2008) and supported by evidence from several research centres (Balaguer et al., 2012; Hancox, Quested, Ntoumanis, & Duda, 2017), when an individual's psychological needs for autonomy (i.e., provision of choice), competence (i.e., feelings of effectiveness) and relatedness (i.e., sense of belongingness) *are all* supported in a social context (e.g., from a coach in sport), they experience psychological needs satisfaction and positive mental health (see Figure 1). Equally, an athlete's psychological needs can be controlled in a sporting context, for example, when a coach purposely isolates athletes from others (i.e., relatedness control), forces or pressures athletes to behave in accordance with their motives (i.e., autonomy control), and points out that the athlete will fail (i.e., competence control). A number of studies show that controlling environments are linked to needs frustration (Bartholomew, Ntoumanis, Ryan, Bosch & Thøgersen-Ntoumani, 2011) and ill-being outcomes, including burnout (Bartholomew, Ntoumanis, Ryan & Thøgersen-Ntoumani, 2011; Hancox, Quested, Ntoumanis, & Duda, 2017).

Please insert Figure 1: Process model informed by BPNT (Ryan & Deci, 2008) explaining the hypothesised positive and negative effects of the coach-led social

environment on athletes' psychological needs satisfaction/frustration and positive and negative forms of functioning.

While the above studies have advanced our understanding of how needs-supportive and controlling environments, and their salutary and detrimental outcomes are distinct, a notable limitation of existing research is the ~~over~~sole- reliance on variable-centred analyses (Hancox, Quested, Ntoumanis, & Duda, 2017). Specifically, researchers using the variable-centred approach (e.g., linear regression) assume a homogenous population, and how relative to the population's mean, higher or lower scores on independent variable(s) explain variance in mediators and outcomes (Magnusson, 1998). To provide ~~an~~ example, the hypothesised covariance pathway between needs-support and needs-control in Figure 1 indicates that, compared to the average, athletes who perceive high levels of needs-support from their coach are more likely to experience less controlling behaviours from their coach (and vice versa), and subsequent needs-satisfaction/frustration, and mental health outcomes (Bartholomew, Ntoumanis, Ryan & Thøgersen-Ntoumani, 2011; Hancox, Quested, Ntoumanis, & Duda, 2017). Contrastingly, a person-centred analys~~e~~is focuses on the relationships between people on the aforesaid interactions between needs-supportive and needs-controlling perceptions (Myers, Ntoumanis, Gunnell, Gucciardi & Lee, 2018). Using Latent Profile Analysis (LPA), the interaction effects in Figure 1 are calculated in a mixture model to extract unobserved latent populations who are quantitatively and qualitatively distinct from others (Magnusson, 1998). The addition of more or fewer latent profiles to the data is determined through comparison of numerous model fit statistics and entropy classifications, wherein the best-fitting model can be retained for theoretical interpretation and advancement (Magnusson, 1998).

To provide illustration, and hypothesised in line with variable-centred study findings (e.g., Bartholomew, Ntoumanis, Ryan, Bosch & Thøgersen-Ntoumani, 2011) an 'optimal' athlete profile would concurrently report high levels of needs-support and low levels of needs-control for all three needs, whereas a 'non-optimal' profile would simultaneously report low levels of needs-support and high levels of needs-control for one or more psychological needs (Hancox, Quested, Ntoumanis, & Duda, 2017). However, given LPA has increased statistical sensitivity to capture nuance in the needs-supportive and needs-controlling interactions (Myers, Ntoumanis, Gunnell, Gucciardi & Lee, 2018), there are both intuitive and theoretical reasons to expect the emergence of a 'need-indifferent' profile who~~'~~se needs may be relatively overlooked (Cheon et al., 2018) displaying moderate scores

across all needs-support and needs-control variables, or~~,~~ indeed; unique profile(s) who receive varied support and control for one or more basic psychological needs (e.g., a largely autonomy-controlling, but competence-promoting coach) (Neubauer, Voss & Ditzen, 2018). Several emerging SDT studies have demonstrated the contribution of LPA in profiling individuals through synergistic effects of motivational regulations in exercise or sport (e.g., Lindwall et al., 2017; Bechter et al., 2018; Gustafsson, Carlin, Podlog, Stenling, & Lindwall, 2018), however, all have analysed psychological needs as study outcomes.

Given psychological needs-support and control variables represent modifiable socio-environmental factors (Fortier et al., 2012), LPA may obtain advanced theoretical knowledge, and applicable information to athletes that motivational or variable-centred studies could not. Moreover, a further advantage of LPA is its ability to ~~achieve~~ convert to a ~~more~~ hybrid ~~comprehensive~~ approach to hypotheses testing, as the uniqueness of an athlete's membership of a profile can be used to better understand and explain relationships between predictor (i.e., social environment) and outcome variables (i.e., mental health) (Lindwall et al., 2017). To this end, while variable-level evidence could infer clear differences between 'optimal' an 'non-optimal' profiles on mental health outcomes, it is unclear how 'needs-indifferent' or 'mixed' profiles would translate to such comparisons (Myers, Ntoumanis, Gunnell, Gucciardi & Lee, 2018).

Hence, with the increasing recognition that theory-based studies are needed to advance athlete mental health research and practice (Breslin et al., 2017; Breslin & Leavey, 2019; Shannon et al., 2019), ~~using~~ a hybrid approach of extracting latent profiles of athletes based on their coaches' interpersonal style and testing how profile membership may relate to mental health outcomes is warranted. ~~, may offer novel theoretical developments and guide future intervention research design in sport.~~ Therefore, the aim of the present study was twofold: (i) to identify if latent profiles of athletes emerge based on the interaction effects of needs-supportive and needs-controlling coach behaviours, and; (ii) to determine if latent profile membership is related to the satisfaction/ frustration of psychological needs, burnout, and subjective vitality.

1.2 Hypotheses tested

Reflective of the hybrid person and variable-centred study aims, our hypotheses consisted of sections A~~a~~ and B~~btwo sections~~. ~~First, as LPA on athletes' perceptions of needs-supportive/controlling behaviours has yet to be tested,~~ In section A,~~a,~~ our LPA hypotheses

was exploratory in nature given LPA on athletes' perceptions of needs-supportive/controlling behaviours has yet to be tested. However, in accordance with BPNT (Ryan & Deci, 2008) and published covariances between needs-support and needs-control constructs in extant variable-centred research (e.g., Bartholomew, Ntoumanis, Ryan & Thøgersen-Ntoumani, 2011; Hancox, Quested, Ntoumanis, & Duda, 2017), we hypothesised that distinct optimal (Hypothesis 1, H_{1a}) and non-optimal profiles (Hypothesis 2, H_{2a}) would emerge. The optimal profile was expected to be characterised by a more-to-less ratio of needs-supportive and controlling coach behaviours, whereas the non-optimal profile was hypothesised to present the reverse. We also expected there to be at least one profile displaying 'needs-indifferent' profile (Hypothesis 3, H_{3a}), displaying moderate needs-support/control, and one novel profile (Hypothesis 4, H_{4a}) that displayed ~~variance, and/or~~ overlap in the levels of psychological needs support/control perceived.

~~Second~~In section ~~b~~B, when applying profile membership as a predictor of mental health outcomes, we hypothesised that relative to other profiles, profiles of athletes who displayed lower levels of perceived coach controlling behaviour and higher levels of coach needs-support, would display the following: reduced burnout symptoms (Hypothesis 1, H_{1b}); lower psychological needs frustration scores (Hypothesis 2, H_{2b}); higher psychological needs satisfaction (Hypothesis 3, H_{3b}), and enhanced subjective vitality (Hypothesis 4, H_{4b}). Additionally, we controlled for several variables linked with athlete mental health including gender, competitive athlete level, and seasonal stage (Lonsdale, Hodge & Rose, 2009; Gustafsson, DeFreese, & Madigan, 2017).

2.0 Methods

2.1 Inclusion criteria, recruitment, procedure and participants

Ethical approval was granted by Ulster University (May, 2018). Inclusion criteria was based on informed consent, being over the age of 18, and responding 'yes' to the following self-report question consistent with the definition of sport, 'are you an athlete involved in a structured, competitive physical activity?' (Rejeski & Brawley, 1988).

Data was collected via an online survey from May 2018 to May 2019 using SurveyMonkey (Palo Alto, CA) software, adhering to the Data Protection Act (2018) provisions, ~~and~~ including cyber security policies and quality control checks. To achieve a broad representation (i.e., level, gender, sport type) of athletes, an email invitation was sent to several sports clubs, interest groups, and national governing bodies across Ireland and the

United Kingdom. Those participating distributed survey links on Twitter, email lists, and SMS/WhatsApp messages to team coaches, captains and players. The survey comprised a description of the study aims, a consent form, and participant demographic (i.e., gender, age) and sporting factors (i.e., sport type, average training and competition hours per-week), level of competition (i.e., elite, semi-elite, amateur) and stage of season (i.e., early-season, mid-season, end-season, off-season); (Lonsdale, Hodge & Rose, 2009), and psychometric scales (described below). The survey was voluntary and took participants approximately nine minutes to complete.

2.2 Psychometric scales

Coaches' interpersonal behaviours

The 24-item Interpersonal Behaviours Questionnaire (IBQ; Rocchi, Pelletier & Desmarais, 2017) was used to measure athletes' perceptions of their main coaches' needs-supportive and controlling behaviours. The IBQ includes four-item subscales for each respective psychological need supported/controlled, ~~(n=6),~~ all scored on a 7-point Likert scale ranging from strongly disagree (1) to strongly agree (7) (Rochhi et al., 2017). Two example items include; 'My coach gives me the freedom to make my own decisions' (i.e., autonomy support), and 'My coach imposes their decisions on me' (i.e., autonomy control). Consistent with prior research (Rocchi, Pelletier & Desmarais, 2017), a robust six-factor model ($\chi 2$= 826.432 (237) $p<.001$; CFI=.955; TLI=.947; GFI=.906; RMSEA=.061) was calculated that outperformed a comparative unidimensional model (see Supplementary Table 1). Cronbach's alpha ranged from .86 (Competence--Support) to .93 (Relatedness--Control) in the present sample.

Psychological needs satisfaction and frustration

The 18-item Need Satisfaction and Frustration Scale (NSFS; Longo, Gunz, Curtis & Farsides, 2016) was adapted to measure athletes' perceptions of psychological needs satisfaction and frustration in their sport. NSFS comprised six 3-item subscales for each psychological need satisfied/frustrated ~~(n=6),~~ and scored from strongly disagree (1) to strongly agree (7). Two examples include: In my sport…'I feel very close and connected with other people' (i.e., relatedness satisfaction), and 'I feel a bit alone when with other people' (i.e., relatedness frustration). A 6-factor model with covariance paths has previously been found in educational contexts (Longo, Gunz, Curtis & Farsides, 2016; Longo, Alcaraz-Ibáñez & Sicilia, 2018). However, given the NSFS has not been tested among athletes, we conducted a Confirmatory

Factor Analysis (CFA) and acceptable-to-good fit indices were found ($\chi 2$= 598.405 (120) p<.001; CFI=.926; TLI=.906; GFI=.909; RMSEA=.076), which substantially exceeded a comparative unidimensional model (see Supplementary Table 1). Cronbach's Alpha values ranged from .72 (Autonomy Frustration) to .90 (Competence Satisfaction).

Athlete burnout

The Athlete Burnout Questionnaire (ABQ; Raedeke & Smith, 2001) included three five-item sub-scales for emotional and physical exhaustion (e.g., "I feel overly tired from my sports participation"), reduced sense of accomplishment (e.g., "I'm not achieving much in sport") and sport devaluation (e.g., "I have negative feelings towards sport"). A 5-point Likert scoring system was used, ranging from 1 (Almost never) to 5 (Almost Always). Excellent psychometric properties have been found for the ABQ among several athlete populations (Gustafsson, Madigan & Lundkvist, 2016; Gerber et al., 2018). Cronbach's Alpha ranged from .82 (Reduced Accomplishment) to .83 (Sport Devaluation).

Subjective vitality

Subjective vitality was assessed using an adapted version Ryan and Frederick's (1997) 6-item scale, using 7-point Likert scaling ranging from "not at all" (1) to "very true" (7). An example item includes: "(During sport) I feel energised". Several studies have shown sound psychometric properties for a one-factor subjective vitality model in athletes (Ryan & Deci, 2017; Li, 2010). Cronbach's Alpha was .84.

2.3 Data management

Raw data was transferred into SPSS (Version 25; IBM Corp, NY), and two of the research team checked each individual item and inspected for outliers and non-normality for quality assurance. Across all values, Skewness (highest= 1.648) and Kurtosis (highest = 3.169) were within acceptable ranges for parametric testing (Kim, 2013). Based on available information, through applying the Expectation Maximisation (EM) algorithm using intercorrelated scale items (Field, 2013), Little's Missing Completely at Random test (p >.05) indicated that the null hypothesis that the missing data were missing completely at random (MCAR) cannot be rejected, suggesting it is unlikely that the missing data in the raw dataset are missing not at random.~~Little's Missing Completely at Random test (p >.05) suggested missing data indictors were missing completely at random (MCAR) in relation to observed and missing data. confirmed that the data was missing in random order (p >.05), and t~~To this end, the

~~Expectation Maximisation algorithm was conducted using intercorrelated scale items as predictors (Field, 2013).~~

2.3 Statistical analyses

LPA was conducted using Mplus version 7.3 (Muthén & Muthén, 2012), and a series of models from one to six latent profiles were tested using maximum likelihood estimation with robust standard errors (MLR) (Magnusson, 1998). We did not include covariates due to the risk of assumption violation in ~~the~~ LPA (Marsh et al., 2009). Model fit solutions were determined through comparison of several recommended fit statistics (Myers, Ntoumanis, Gunnell~~,~~, Gucciardi & Lee, 2018), including; the Bayesian information criterion (BIC), sample-size-adjusted BIC (aBIC), Akaike information criterion (AIC), Vuong–Lo–Mendell–Rubin Likelihood Ratio Test (LRT), and Lo–Mendell–Rubin adjusted LRT (aLRT). Lower AIC, BIC, and aBIC values signify a better fitting model. To illustrate, an elbow plot outlining changes (Δ**)** in information criterion for profiles 2 through to 6 were calculated in Figure 3. LRT values indicate whether the model fits significantly better ($p < .05$) than a solution with one fewer profile, however statistical sensitivity was considered (Henson, Reise & Kim, 2007). The entropy criterion (values of > 0.80 indicate acceptable model fit) was reported, with higher entropy scores suggesting improved model fit. Individuals were then assigned to respective profiles based on average posterior probabilities. The aforesaid fit indices were reported alongside the percentages of the sample within each profile in Table 1. Lastly, interpretation value, theoretical meaningfulness, and profile sample size were considered when choosing the final model (Lindwall et al., 2017). To support interpretation of the final model, figurative labels were applied to retained profiles, and profile total mean scores were reported in Table 2, then standardised as z-scores and inputted into a bar chart (~~see~~ Figure 2).

Following LPA, we assessed whether profile membership predicted variance in study outcomes of psychological needs-satisfaction/frustration variables, burnout dimensions, and subjective vitality using a multivariate analysis of covariance (MANCOVA) using SPSS (version 25). Profile memberships was applied as the independent variable, with gender, level of participation (i.e., elite, semi-elite, amateur) and season stage (i.e., pre, early, mid or end season) included as fixed controlling factors. Partial Eta Squared (η_p^2) was reported to determine the strength of effects with values of .01, .06 and ≥.14 interpreted as small,

medium and large effects, respectively (Field, 2013). Adjusted R^2 values were reported for the total proportion of variance predicted for each outcome, and after revealing significant multivariate effects based on $p < .05$, we used a Bonferroni post-hoc test to assess comparisons between retained latent profiles. ~~Unstandardized p~~Profile total mean scores and unstandardized mean score comparisons were ~~further~~ reported in Table 3.

3.0 Results

3.1 Descriptive statistics

A total of 685 athletes took part (mean age = 23.39, -SD = 6.22, -71% = male) with 90.50% of the sample in 'early' to 'mid-season', while 4.70% were in 'pre' or 'end-season', and 4.90% in 'off-season'. Ninety two percent of the sample took part in interactive team sports, while 8% participated in co-active sports. Over half, 58.40%, reported they competed at amateur level (i.e., local/county leagues), 25.90% at semi-elite (i.e., semi-professional, regional or country representative), 1.20% elite (i.e., professional, international), and 14.50% recreational (i.e., primary purpose of the sport is participation). On average, participants took part in 5.95 (SD: 2.53) and 2.25 (SD: 1.41) hours of training and competition per-week, respectively. A correlations matrix and further descriptive statistics for the study outcomes, split by demographic and sporting factors are presented in Supplementary Tables 9 and 10.

3.2 Latent profile analyses

Model fit statistics for the iterative profile extraction process are reported in Table 1. The elbow plot (see Figure 3) showed that with the addition of more profiles the Δ in AIC, BIC, and aBIC decreaseds. However, the flattest Δ angle occurred between profiles five and six, demonstrating a level of diminishing returns after five profiles. LRT ratio tests showed that both two and three profiles were a significantly better (p <.001) fit than one fewer profile, but four profiles were not significantly better than three (p >. 05). However, five profiles were a significantly better fit than four ($p < .05$), and supporting the information criterion changes, six profiles were not significantly better than five (p >. 05). -Entropy was highest at a 2-profile solution, followed by a 5-profile solution. Taken ~~the above~~ collectively, the 5-profile solution was retained as the best-fitting model, and displayed a quantitatively and qualitatively sound model with sufficient theoretical interpretability and parsimony. The five distinct profiles were further supported by consistently high posterior probability classification values of: 0.93, 0.94, 0.95, 0.97 and 0.91.

Please insert Table 1, and Figure 3

3.3 Retained 5-Profile Solution

Mean total IBQ scores for the five retained latent profiles are presented in Table 2. Relative to the sample total means, Profile 1 (n= 191, 27%) displayed high levels of needs-supportive behaviours, and lowest levels of controlling behaviours, ~~was~~ and thus supported H_{1a}, labelled as 'Supportive-Developmental Coach' ~~.~~ focused on athlete well-being and psychological growth. Supporting H_{3a} Profile 2 (n=366, 53%) showed moderate levels across all IBQ variables and was thus labelled as a 'Needs-Indifferent Coach' to denote a lack of strong interpersonal behaviours in either direction. Conversely, Profiles 3-5 displayed similar patterns of lower needs-supportive behaviours and higher controlling behaviours. However, both within and across profiles, the separations between support and control over each need were most pronounced in Profile 4 (n=28, 4%), henceforth labelled as a 'Harsh Controlling Coach', supporting H_{2a}. ~~.~~ Profiles 3 (n= 52, 8%) and 5 (n=48, 7%) indicated that while all variables were higher or lower than the ~~general~~ sample total means in an undesirable direction, the largest separations occurred for competence-control (Profile 3) and relatedness-control (Profile 5). Those profiles were not expected, respectively labelled as: 'Overly Critical Coach' and 'Distant Coach'~~.~~. No support for H_{4a} was found as no profile displayed overlapping high needs-control and needs-support. Figure 2 illustrates the balance between needs-supportive and needs-controlling behaviours for the five retained profiles through z-score values in a bar graph. Overall, Section A~~a~~1 of the study hypotheses had ~~sound~~ support as both optimal (i.e., Supportive-Developmental), non-optimal (i.e., Harsh Controlling) and moderate (i.e., Needs Indifferent) profiles emerged. However, we did not predict the emergence the 'Overly Critical Coach' and 'Distant Coach', and thus displays novel latent groupings of athletes.

Please insert Table 2 and Figure 2

3.4 Profile membership as a predictor of mental health outcomes

After adjustment for covariate effects (see Supplementary Table 9), the corrected model revealed a significant effect for profile membership on the three burnout dimensions of emotional and physical exhaustion (F (5, 680) =13.140, $p < 0.01$, $\eta p^2 = .18$, $R^2 = .17$), reduced accomplishment (F (5, 680) =18.687, $p < 0.01$, $\eta p^2 = .22$, $R^2 = .22$) and sport devaluation (F (5,

680) =17.628, $p < 0.01$, $\eta p^2 = .16$, $R^2 = .15$), yielding large effects. A further multivariate effect was found for competence frustration (F (5, 680) =8.802, $p < 0.01$, $\eta p^2 = .12$, $R^2 = .10$) and satisfaction (F (5, 680) =16.904, $p < 0.01$, $\eta p^2 = .14$, $R^2 = .13$); relatedness frustration (F (5, 680) =12.083, $p < 0.01$, $\eta p^2 = .17$, $R^2 = .15$) and satisfaction (F (5, 680) =21.532, $p < 0.01$, $\eta p^2 = .13$, $R^2 = .12$), and; autonomy frustration (F (5, 680) =13.129, $p < 0.01$, $\eta p^2 = .25$, $R^2 = .19$) and satisfaction (F (5, 680) =27.330, $p < 0.01$, $\eta p^2 = .27$, $R^2 = .25$), ~~again~~ yielding moderate-to-large effects. Lastly, profile membership revealed a significant effect on subjective vitality (F (5, 680) =18.771, $p < 0.01$, $R^2 = .16$) with a large effect size ($\eta p^2 = .19$).

Bonferroni post-hoc comparisons revealed support for section B~~b~~ of the~~the~~ study hypotheses, to the extent that the 'Supportive-Developmental' profile was the most likely to score favourably on all of the study outcomes ($H_{1b, 2b, 3b, 4b}$;see Table 3). Further hypotheses support was shown in that the largest unstandardized mean differences were between the 'Supportive-Developmental' and 'Harsh-Controlling' profiles for five outcomes, followed by the 'Supportive-Developmental' and 'Overly Critical' profiles for three outcomes, and the 'Supportive-Developmental' and 'Distant Controlling' profiles for two outcomes. Moreover, all unstandardized mean differences between the 'Supportive-Developmental' and 'Needs-Indifferent' profiles were notably smaller in size when compared to differences between the 'Supportive-Development' and 'Harsh-Controlling' or 'Distant Controlling' or 'Overly Critical' coach profiles.

Showing a somewhat linear manner in the relative balance of needs-supportive to needs-controlling coach behaviours in profiles, the 'Needs-Indifferent' profile scored more favourably on nine of ten study outcomes (albeit many did not reveal statistical significance), when compared to the 'Harsh-Controlling', 'Distant Controlling' and 'Overly Critical' coach profiles. The remaining profile comparisons were between those reflective of higher needs-controlling behaviours and demonstrated some novel findings. Specifically, and consistent with the figurative labels applied, the 'Overly Critical' coach profile displayed the lowest levels of competence satisfaction, and highest levels of competence frustration; albeit, the differences were not statistically significant. Moreover, the 'Distant Controlling' coach profile reported the lowest levels of relatedness satisfaction, which was statistically different when compared to the 'Overly Critical' coach profile. Lastly, the 'Harsh Controlling' profile displayed the lowest levels of autonomy satisfaction (among other outcomes), with significant differences between both the 'Overly Critical' and 'Distant Controlling' coach profiles.

Please insert Table 3~~: Retained profile mean scores and mean score comparisons through Bonferroni adjusted post-hoc comparisons.~~

4. 0 Discussion

~~As most~~This study advanced BPNT ~~studies have primarily adopted the~~by combining traditional variable-centred approach (e.g., Balaguer et al., 2012; Li, Wang, & Kee, 2013; Bartholomew, Ntoumanis, Ryan & Thøgersen-Ntoumani, 201), ~~we opted for a~~with a person-centred LPA approach, ~~and~~ extract~~inged~~ latent profiles of athletes from the interactive effects of perceived need-supportive and need-controlling coach behaviours. The iterative LPA extraction process revealed five novel, and quantitatively and qualitatively distinct profiles, wherein profile membership subsequently predicted significant ~~proportions of~~ variance in mental health outcomes. Indeed, we find the emergence of a 'Supportive-Developmental' profile delineated by a coach focused on athlete well-being~~,~~ and displaying the most positive mental health outcomes ($H_{1b,2b,3b,4b}$). However, three diverse profiles reflective of a more needs-controlling coach emerged~~,~~ and showed increased burnout symptomology and deleterious levels of needs-satisfaction and frustration. Collectively, the findings provide novel advancements to BPNT (Ryan & Deci, 2008), to the extent that substantial nuance was highlighted ~~in the perceived levels of coach needs-support and control~~ in athletes' social context, likely uncaptured by existing variable-centred studies. The retained profiles ~~underscore~~highlight ~~ed~~the subsequent mental health effects of such environments, wherein profiles characteristic of needs-controlling or needs-indifferent coaches could be targeted for interventions to promote needs-supportive coaching communication (Hancox, Quested, Ntoumanis, & Duda, 2017).

4.1 Latent profile analysis

The composition of the five retained profiles supported Ryan & Deci's (2008) characterisation of social environments reflecting varying degrees of needs-supportive and controlling coach behaviours ($H_{1a,2a,3a,4a;}$ Bhavsar et al., 2019). Existing covariance values in BPNT studies ~~(e.g., Bartholomew, Ntoumanis, Ryan & Thøgersen-Ntoumani, 2011; Hancox, Quested, Ntoumanis, & Duda, 2017) would~~ support~~ed~~ the emergence of the 'Supportive-Developmental' and 'Harsh-Controlling' profiles, displaying inverse relationships between needs-controlling needs-supportive behaviours, and ~~. For example, environments~~

~~characterised by a ratio of more-to-less needs-supportive and controlling behaviours~~ are evident ~~in profiles in~~ educational, athlete ~~-~~and physical activity ~~studies~~ samples (Jaakkola, Wang, Soini & Liukkonen, 2015; Esdar, Gorges & Wild, 2016; ~~), and in athlete samples using cluster-based analysis (~~Matosic, & Cox, 2014, Haerens et al., 2018). However, the extraction of 'Needs-Indifferent', 'Distant Controlling' and 'Overly Critical' coach profiles are novel contributions to the BPNT literature.

Specifically, ~~T~~the relative lack of direction of perceived needs-support/control in either way suggests a 'Need-Indifferent' profile of athletes who may feel their needs are not actively thwarted or supported, but perhaps overlooked by their coach (Bhavsar et al., 2019). In an educational context, Cheon et al. (2018, p687) were the first to describe need-indifferent teachers who: 'in tone, content, and interpersonal behaviour…pays little or no attention to the student's needs, goals, or concerns, usually because the teacher pays so much attention to his or her own needs, goals, and concerns'. However, it's important to highlight that 'need-indifferent' coach behaviours were not explicitly assessed, and further work will need to differentiate the factor structure of the construct (Costa, Ntoumanis & Bartholomew, 2015). The additional retained profiles labelled as 'Distant Controlling' and 'Overly Critical' coaches, showed unique and novel features to athletes' social environments, ~~that would~~ likely ~~be~~ uncaptured by a variable-centred analysis (e.g., linear regression) (Myers, Ntoumanis, Gunnell, Gucciardi & Lee, 2018). Supporting the SDT position that some coaches give preferential treatment to one or more needs (Ryan & Deci, 2000) ~~Specifically,~~ the 'Distant Controlling' profile displayed elevated levels of relatedness frustration and low relatedness satisfaction, and the 'Overly Critical' profile reported low levels of competence satisfaction and high levels of competence frustration. Further examination of profile total mean values (~~see~~ Table 3) indicates that the 'Overly Critical' profile's relatedness satisfaction/frustration, and the 'Distant Controlling' profile's competence satisfaction/frustration were relatively close to the sample total meanss. ~~Such findings support the SDT position that some coaches give preferential treatment to one or more needs (Ryan & Deci, 2000).~~

~~Most relevant from the LPA findings, t~~The high prevalence (i.e., 72%) of the less-optimal profiles (i.e., excluding the 'Supportive-Developmental') underscores the need for interventions designed to increase sport coaches' adoption of needs-supportive principles (Hancox, Quested, Ntoumanis, & Duda, 2017). In order to practically address such issues, evidence suggests that individuals can be receptive to their coach~~es~~'s modified interpersonal style through the use of SDT-informed behaviour change techniques and communication

strategies (Ntoumanis, Quested, Reeve & Cheon, 2018). Such examples include: provision of activity choice and participant input (Shannon et al., 2018); acknowledgement of barriers and conflict (Fin et al., 2019); use of open-ended questions (Cheon, Reeve, Lee & Lee, 2015), and; positive instructional feedback (Ntoumanis, ThøgersenNtoumani, Quested & Hancox, 2017). Equally, Delrue et al., (2019) suggests that athletes can identify controlling coaches' practices (e.g., domineering, demanding) that are detrimental to well-being, and preliminary evidence suggests individuals can differentiate indifferent instructor styles (Cheon et al., 2018). Therefore, coach education programmes could raise awareness of, and identify non-optimal communication practices to discourage controlling or impersonal coach behaviours (see Bartholomew, Ntoumanis, & Thorgersen-Ntoumani, 2009 for a review).

4.2 Profile membership as a predictor of mental health outcomes

The contribution of extracting latent profiles was further supported in the variable-centred results ~~of the MANCOVA~~, which emphasised how unique needs-supportive/controlling contexts may have ~~differential~~ adaptive and maladaptive effects on athlete mental health outcomes. This position is strengthened by our analysis which included several statistical controls that have been linked with athlete mental health, including gender, seasonal stage, and competitive levels, (Lonsdale, Hodge & Rose, 2009; Gustafsson, DeFreese, & Madigan, 2017). Specifically, and with statistically significant comparisons with all respective groups, the 'Supportive-Developmental' profile yielded the highest psychological needs-satisfaction (H_{3b}) and subjective vitality (H_{4b}) scores, and lowest levels of psychological needs-frustration (H_{2b}), and two burnout dimensions of accomplishment and sports devaluation (H_{1b}). Contrastingly, the 'Harsh-Controlling' profile scored the highest in the two burnout dimensions of accomplishment and sports devaluation, autonomy and relatedness frustration, and lowest autonomy satisfaction, whereas the 'Distant-Controlling' and 'Overly Critical' profiles yielded the highest or lowest total mean values in an undesirable direction for the remaining variables. Taken collectively, our study supports a ~~comprehensive~~ growing body of research indicating the influential role of needs-supportive social environments on sports-specific markers of athlete mental health (Langan, Toner, Blake, & Lonsdale, 2015; Balaguer et al., 2012; Hancox, Quested, Ntoumanis, & Duda, 2017).

Considered within an SDT process framework (see Figure 1), the predictive role of the 'Supportive-Developmental' and 'Harsh-Controlling' profile membership on both needs satisfaction (H_{3b}) and needs frustration (H_{2b}) supports a corpus of literature supporting SDT

hypotheses across domains and cultural contexts (Ryan & Deci, 2017). However, a novel contribution was how, consistent with the figurative labels applied, the 'Overly Critical' coach profile displayed the lowest levels of competence satisfaction, and highest levels of competence frustration, and the 'Distant Controlling' coach profile reported the lowest levels of relatedness satisfaction. These findings suggest a ~~clear influence~~n undesired effect if differential support/control is exerted over one or more psychological needs (Ryan & Deci, 2017).

~~-~~Importantly, athletes' and coaches' agreements/disagreements regarding their coaches' behaviours are significant for the relative prediction of needs satisfaction/frustration (Rocchi & Pelletier, 2018). As such, both athletes and coaches may benefit from participating in needs-supportive communication interventions (Ntoumanis, Quested, Reeve & Cheon, 2018). Furthermore, of all the needs-satisfaction/thwarting variables, profile membership predicted the largest proportion of variance for autonomy satisfaction, and the least for competence frustration. These results are consistent with a recent review of 20 studies examining the relative influence of social agents on athletes' psychological needs, in which coaches exerted the largest effect on autonomy, but peers were more influential regarding competence (Chu & Zhang, 2019). Therefore, further BPNT research may consider examining the co-occurrence of needs-supportive/controlling behaviours from both coaches and peers, which may explain more variance in athletes' psychological needs (Jõesaar, Hein & Hagger, 2012; Quested et al., 2013). Understanding the influence of needs indifferent behaviours is also likely to explain more variance in needs-satisfaction/ frustration (Bhavsar et al., 2019).

The finding that ~~either~~ the 'Harsh-Controlling' ~~or 'Overly Critical' profiles~~ scored the highest in ~~all~~ burnout dimensions (H_{1b}) supports a recent meta-analysis that revealed negative associations with social support and burnout, and ~~positive~~ direct ~~links~~ relationships between negative social interactions and burnout (Pacewicz, Mellano, & Smith, 2019). Research suggests that controlling coach behaviours can result in an increased probability of athlete preoccupation with concern about mistakes, avoidance of failure, and subsequent devaluation and cynicism about their sport (Lonsdale, Hodge & Rose, 2009; Gustafsson, DeFreese & Madigan, 2017). Lastly, the large effect explained by profile membership (H_{4ba}) on subjective vitality is consistent with several athlete mental health studies (Adie, Duda, & Ntoumanis, 2008; Adie, Duda, & Ntoumanis, 2012; Balaguer et al., 2012; Hancox, Quested, Ntoumanis,

& Duda, 2017). This finding adds to the view that athletes feel more energy during their sport when they feel their needs are supported by their coach..

4.3 Limitations and future directions

While the present study extended the testing of BPNT in sport, there are some limitations. For instance, we employed a cross-sectional design and therefore causal inferences cannot be drawn. An additional sample in our study would have determined profile consistency, or indeed longitudinal prospective research could help determine temporal patterns of profile membership(s) over the course of a competition season (Lindwall et al., 2017; Myers, Ntoumanis, Gunnell, Gucciardi & Lee, 2018). In terms of further exploring the effect of psychological needs on athlete mental health, further research may consider measuring global mental health constructs beyond the sports-related outcomes assessed in the present study (see Vallerand, 1997~~ for a conceptual model~~). Further, assessing need indifferent behaviours (Bhavsar et al., 2019) will be important, and to examine the role of peers, that are ~~all~~ likely implicated in athlete mental health. Lastly, future testing of BPNT in longitudinal and intervention studies may consider assessing if needs-satisfaction/frustration exerts a mediating role in motivational components (e.g., amotivation, intrinsic motivation) which were not present in the current analyses.

4.5 Summary and Conclusions

Promoting athlete mental health within sport is an important goal for researchers, practitioners and policy makers (Breslin & Leavey, 2019), and therefore~~,~~ an understanding of influential psychosocial factors is valuable. As such, this study simultaneously employed LPA to profile athletes based on the interaction effects between perceived needs-supportive and controlling coach behaviours, and; applied profile membership as a predictor of mental health outcomes. Study hypotheses were largely supported and revealed the emergence of profiles characteristic of a more needs-supportive, needs-indifferent or controlling social contexts, with the novel additions of athlete profiles displaying differential ~~perceived~~ mis-treatment for their competence and relatedness needs. The predictive role of profile membership on mental health outcomes was also in line with BPNT tenets (Ryan & Deci, 2008) to the extent that ~~profiles~~ the 'Supportive-Development' profile characteristic of a more needs-supportive social context reported improved needs-satisfaction and subjective vitality (Rocchi, & Pelletier, 2018; Quested et al., 2013); whereas the 'Harsh-Controlling' profile~~s reflective of a more controlling environment were~~was linked to maladaptive

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outcomes including psychological needs-frustration and athlete burnout (Hancox, Quested, Ntoumanis & Duda, 2017; Pacewicz, Mellano & Smith, 2019). A key finding of this study is the 72% prevalence rate within less-optimal athlete profiles, who may therefore benefit from interventions designed to promote mental health through needs-supportive communication (Gustafsson, DeFreese, & Madigan, 2017; Hancox, Quested, Ntoumanis, & Duda, 2017). Evidence-based strategies such as increasing athlete choice and input, whilst acknowledging barriers and conflict could be considered in intervention programme development (Ntoumanis, Quested, Reeve & Cheon, 2018). From a research and theoretical perspective, further longitudinal prospective and controlled intervention studies are required, in which the consistency and temporal patterns of profile membership is examined (Lindwall et al., 2017). Such research may consider modelling additional SDT components including need-indifferent behaviours, motivational regulations and needs-support from other social agents such as peers (Li, Wang & Kee, 2013).

References

Adie, J. W., Duda, J. L., & Ntoumanis, N. (2008). Autonomy support, basic need satisfaction and the optimal functioning of adult male and female sport participants: A test of basic needs theory. *Motivation and Emotion, 32*(3), 189-199.

Adie, J. W., Duda, J. L., & Ntoumanis, N. (2012). Perceived coach-autonomy support, basic need satisfaction and the well-and ill-being of elite youth soccer players: A longitudinal investigation. *Psychology of Sport and Exercise, 13*(1), 51-59.

Arnold, R., & Fletcher, D. (2012). A research synthesis and taxonomic classification of the organizational stressors encountered by sport performers. *Journal of Sport and Exercise Psychology, 34*(3), 397-429.

Balaguer, I., González, L., Fabra, P., Castillo, I., Mercé, J., & Duda, J. L. (2012). Coaches' interpersonal style, basic psychological needs and the well-and ill-being of young soccer players: A longitudinal analysis. *Journal of Sports Sciences, 30*(15), 1619-1629.

Bartholomew, K. J., Ntoumanis, N., & Thøgersen-Ntoumani, C. (2009). A review of controlling motivational strategies from a self-determination theory perspective: Implications for sports coaches. *International Review of Sport and Exercise Psychology, 2*(2), 215-233.

Bartholomew, K. J., Ntoumanis, N., Ryan, R. M., & Thøgersen-Ntoumani, C. (2011). Psychological need thwarting in the sport context: Assessing the darker side of athletic experience. *Journal of Sport and Exercise Psychology, 33*(1), 75-102.

Bartholomew, K. J., Ntoumanis, N., Ryan, R. M., Bosch, J. A., & Thøgersen-Ntoumani, C. (2011). Self-determination theory and diminished functioning: The role of interpersonal control and psychological need thwarting. *Personality and Social Psychology Bulletin, 37*(11), 1459-1473.

Belz, J., Kleinert, J., Ohlert, J., Rau, T., & Allroggen, M. (2018). Risk for Depression and Psychological Well-Being in German National and State Team Athletes—Associations With Age, Gender, and Performance Level. *Journal of Clinical Sport Psychology, 12*(2), 160-178.

Bechter, B. E., Dimmock, J. A., Howard, J. L., Whipp, P. R., & Jackson, B. (2018). Student motivation in high school physical education: A latent profile analysis approach. *Journal of Sport and Exercise Psychology, 40*(4), 206-216.

Bhavsar, N., Ntoumanis, N., Quested, E., Gucciardi, D. F., Thøgersen-Ntoumani, C., Ryan, R. M., & Bartholomew, K. J. (2019). Conceptualizing and testing a new tripartite measure of coach interpersonal behaviors. *Psychology of Sport and Exercise.*

Breslin, G. Smith, A. Donohue, B. Donnelly, P. Shannon, S. Haughey, T. Vella, S. Swann, C. Cotterill, S. MacIntyre, T. Rogers, T. & Leavey G (in press). International Consensus Statement on Psychosocial and Policy-Related Approaches to Mental Health Awareness Programmes in Sport. *BMJ Open Sport & Exercise Medicine.*

Breslin, G., Shannon, S., Haughey, T., Donnelly, P., & Leavey, G. (2017). A systematic review of interventions to increase awareness of mental health and well-being in athletes, coaches and officials. *Systematic Reviews, 6*(1), 177.

Breslin, G., Shannon, S., Haughey, T., Sarju, N., Neill, D., Leavey, G., & Lawlor, M. (In press). Athlete and non-athlete Intentions to Self-Manage Mental Health: Applying the Integrated Behaviour Change Model to the State of Mind Programme. *Journal of Applied Sport Psychology.*

Breslin, G., and Leavey, G. (2019). Mental Health and Well-being Interventions in Sport: Research, Theory and Practice. Routledge, London.

Cheon, S. H., Reeve, J., Lee, J., & Lee, Y. (2015). Giving and receiving autonomy support in a high-stakes sport context: A field-based experiment during the 2012 London Paralympic Games. *Psychology of Sport and Exercise, 19,* 59-69.

Cheon, S. H., Reeve, J., Lee, Y., Ntoumanis, N., Gillet, N., Kim, B. R., & Song, Y.-G. (2019). Expanding autonomy psychological need states from two (satisfaction, frustration) to three (dissatisfaction): a classroom-based intervention study. Journal of Educational Psychology, 11, 685-702. doi: 10.1037/edu0000306

Chu, T. L., & Zhang, T. (2019). The roles of coaches, peers, and parents in athletes' basic psychological needs: A mixed-studies review. *International Journal of Sports Science & Coaching,* 1747954119858458.

Costa, S., Ntoumanis, N., & Bartholomew, K. (2015). Predicting the brighter and darker sides of interpersonal relationships: Does psychological need thwarting matter?. *Motivation and Emotion*, 39, 11-24. doi: 10.1007/s11031-014-9427-0

Cramer, D. & Howitt, D. (2004). The Sage dictionary of statistics: a practical resource for students in the social sciences. Thousand Oaks: Sage, London.

592 Delrue, J., Reynders, B., Broek, G. V., Aelterman, N., De Backer, M., Decroos, S., & Haerens,
593 L. (2019). Adopting a helicopter-perspective towards motivating and demotivating
594 coaching: A circumplex approach. *Psychology of Sport and Exercise, 40,* 110-126.

595 Esdar, W., Gorges, J., & Wild, E. (2016). The role of basic need satisfaction for junior
596 academics' goal conflicts and teaching motivation. *Higher Education, 72*(2), 175-190.

597 Field, A. (2013). Discovering statistics using IBM SPSS statistics. Sage, London.

598 Fin, G., Moreno-Murcia, J. A., León, J., Baretta, E., & Júnior, R. J. N. (2019). Interpersonal
599 autonomy support style and its consequences in physical education classes. *PloS one,*
600 14(5), e0216609.

601 Felton, L., & Jowett, S. (2013). "What do coaches do" and "how do they relate": Their effects
602 on athletes' psychological needs and functioning. *Scandinavian Journal of Medicine &*
603 *Science in Sports, 2*3(2), e130-e139.

604 Fortier, M. S., Duda, J. L., Guerin, E., & Teixeira, P. J. (2012). Promoting physical activity:
605 development and testing of self-determination theory-based interventions. International
606 *Journal of Behavioral Nutrition and Physical Activity, 9*(1), 20.

607 Foskett, R. L., & Longstaff, F. (2018). The mental health of elite athletes in the United
608 Kingdom. *Journal of Science and Medicine in Sport, 21*(8), 765-770.

609 Gerber, M., Gustafsson, H., Seelig, H., Kellmann, M., Ludyga, S., Colledge, F., & Bianchi, R.
610 (2018). Usefulness of the Athlete Burnout Questionnaire (ABQ) as a screening tool for the
611 detection of clinically relevant burnout symptoms among young elite athletes. *Psychology*
612 *of Sport and Exercise, 39,* 104-113.

613 Gustafsson, H., DeFreese, J. D., & Madigan, D. J. (2017). Athlete burnout: Review and
614 recommendations. *Current Opinion in Psychology, 16,* 109-113.

615 Gustafsson, H., Carlin, M., Podlog, L., Stenling, A., & Lindwall, M. (2018). Motivational
616 profiles and burnout in elite athletes: A person-centered approach. *Psychology of Sport and*
617 *Exercise, 35,* 118-125.

618 Haerens, L., Vansteenkiste, M., De Meester, A., Delrue, J., Tallir, I., Vande Broek, G., Goris,
619 W. & Aelterman, N. (2018). Different combinations of perceived autonomy support and
620 control: identifying the most optimal motivating style. *Physical Education and Sport*
621 *Pedagogy, 23*(1), 16-36.

622 Hagger, M. S., & Weed, M. (2019). DEBATE: Do interventions based on behavioral theory
623 work in the real world? *International Journal of Behavioral Nutrition and Physical*
624 *Activity, 16*(1), 36.

625 Hancox, J. E., Quested, E., Ntoumanis, N., & Duda, J. L. (2017). Teacher-created social
626 environment, basic psychological needs, and dancers' affective states during class: A diary
627 study. *Personality and Individual Differences, 115,* 137-143.

628 Jaakkola, T., Wang, C. J., Soini, M., & Liukkonen, J. (2015). Students' perceptions of
629 motivational climate and enjoyment in Finnish physical education: A latent profile analysis.
630 *Journal of Sports Science & Medicine, 14*(3), 477.

631 Jõesaar, H., Hein, V., & Hagger, M. (2012). Youth athletes' perception of autonomy support
632 from the coach, peer motivational climate and intrinsic motivation in sport setting: One-
633 year effects. *Psychology of Sport and Exercise, 13,* 257–262.

634 Keyes, C. L. (2005). Mental illness and/or mental health? Investigating axioms of the
635 complete state model of health. *Journal of Consulting and Clinical Psychology, 73*(3), 539.

636 Langan, E., Toner, J., Blake, C., & Lonsdale, C. (2015). Testing the effects of a self-
637 determination theory-based intervention with youth Gaelic football coaches on athlete
638 motivation and burnout. *The Sport Psychologist, 29*(4), 293-301.

639 Li, C. H. (2010). Predicting subjective vitality and performance in sports: The role of passion
640 and achievement goals. *Perceptual and Motor Skills, 110*(3_suppl), 1029-1047.

641 Lindwall, M., Ivarsson, A., Weman-Josefsson, K., Jonsson, L., Ntoumanis, N., Patrick, H., &
642 Teixeira, P. (2017). Stirring the motivational soup: within-person latent profiles of
643 motivation in exercise. *International Journal of Behavioral Nutrition and Physical Activity,*
644 *14*(1), 4.

645 Longo, Y., Gunz, A., Curtis, G. J., & Farsides, T. (2016). Measuring need satisfaction and
646 frustration in educational and work contexts: The Need Satisfaction and Frustration Scale
647 (NSFS). *Journal of Happiness Studies, 17*(1), 295-317.

648 Longo, Y., Alcaraz-Ibáñez, M., & Sicilia, A. (2018). Evidence supporting need satisfaction
649 and frustration as two distinguishable constructs. *Psicothema, 30*(1), 74-81.

650 Lonsdale, C., Hodge, K., & Rose, E. (2009). Athlete burnout in elite sport: A self-
651 determination perspective. *Journal of Sports Sciences, 27*(8), 785-795.

652 Lundqvist, C. (2011). Well-being in competitive sports—The feel-good factor? A review of
653 conceptual considerations of well-being. *International Review of Sport and Exercise*
654 *Psychology, 4*(2), 109-127.

655 Magnusson, D. (1998). The logic and implications of a person-oriented approach. In R. B.
656 Cairns, L. R. Bergman, & J. Kagan (Eds.). Methods and models for studying the individual
657 (pp. 33–64). Thousand Oaks, CA: Sage Publications, Inc.

658 Matosic, D., & Cox, A. E. (2014). Athletes' motivation regulations and need satisfaction
659 across combinations of perceived coaching behaviors. *Journal of Applied Sport*
660 *Psychology, 26*(3), 302-317.

661 Marsh, H.W., Lüdtke, O., Trautwein, U., & Morin, A.J.S. (2009). Classical latent profile
662 analysis of academic self-concept dimensions: Synergy of person- and variable-centered
663 approaches to theoretical models of self-concept. Structural Equation Modeling, 16, 191-
664 225.

665 Moesch, K., Kenttä, G., Kleinert, J., Quignon-Fleuret, C., Cecil, S., & Bertollo, M. (2018).
666 FEPSAC position statement: mental health disorders in elite athletes and models of service
667 provision. *Psychology of Sport and Exercise, 38,* 61-71.

668 Muthén, L. K., & Muthén, B. O. (2012). MPlus: statistical analysis with latent variables--
669 User's guide.

Myers, N. D., Ntoumanis, N., Gunnell, K. E., Gucciardi, D. F., & Lee, S. (2018). A review of some emergent quantitative analyses in sport and exercise psychology. *International Review of Sport and Exercise Psychology, 11*(1), 70-100.

Neubauer, A. B., Voss, A., & Ditzen, B. (2018). Exploring need dynamics within and across days in everyday life: A three-level analysis. *Journal of Research in Personality, 77,* 101-112.

Ntoumanis, N., Quested, E., Reeve, J., & Cheon, S. H. (2018). Need supportive communication: Implications for motivation in sport, exercise, and physical activity. In Persuasion and communication in sport, exercise, and physical activity, 155-169, Abingdon, UK: Routledge.

Ntoumanis, N., Thøgersen-Ntoumani, C., Quested, E., & Hancox, J. (2017). The effects of training group exercise class instructors to adopt a motivationally adaptive communication style. *Scandinavian Journal of Medicine & Science in Sports, 27*(9), 1026-1034.

Pacewicz, C. E., Mellano, K. T., & Smith, A. L. (2019). A meta-analytic review of the relationship between social constructs and athlete burnout. *Psychology of Sport and Exercise.*

Quested, E., Ntoumanis, N., Viladrich, C., Haug, E., Ommundsen, Y., Van Hoye, A., & Duda, J. L. (2013). Intentions to drop-out of youth soccer: A test of the basic needs theory among European youth from five countries. *International Journal of Sport and Exercise Psychology, 11*(4), 395-407.

Raedeke, T. D. (1997). Is athlete burnout more than just stress? A sport commitment perspective. *Journal of Sport and Exercise Psychology, 19*(4), 396-417.

Raedeke, T. D., & Smith, A. L. (2001). Development and preliminary validation of an athlete burnout measure. *Journal of sport and exercise psychology, 23*(4), 281-306.

Reardon, C. L., Hainline, B., Aron, C. M., Baron, D., Baum, A. L., Bindra, A., ... & Derevensky, J. L. (2019). Mental health in elite athletes: International Olympic Committee consensus statement (2019). *British Journal of Sports Medicine, 53*(11), 667-699.

Reeve, J., & Lee, W. (2019). A neuroscientific perspective on basic psychological needs. *Journal of personality, 87*(1), 102-114.

Rocchi, M., & Pelletier, L. (2018). How does coaches' reported interpersonal behavior align with athletes' perceptions? Consequences for female athletes' psychological needs in sport. *Sport, Exercise, and Performance Psychology, 7*(2), 141-154. http://dx.doi.org/10.1037/spy0000116#

Rice, S. M., Purcell, R., De Silva, S., Mawren, D., McGorry, P. D., & Parker, A. G. (2016). The mental health of elite athletes: a narrative systematic review. *Sports Medicine, 46*(9), 1333-1353.

Rocchi, M., Pelletier, L., & Desmarais, P. (2017). The validity of the Interpersonal Behaviors Questionnaire (IBQ) in sport. *Measurement in Physical Education and Exercise Science, 21*(1), 15-25.

709 Rocchi, M., Pelletier, L., Cheung, S., Baxter, D., & Beaudry, S. (2017). Assessing need-
710 supportive and need-thwarting interpersonal behaviours: The Interpersonal Behaviours
711 Questionnaire (IBQ). *Personality and Individual Differences, 104,* 423-433.

712 Ryan, R. M., & Deci, E. L. (2000). The" what" and" why" of goal pursuits: Human needs and
713 the self-determination of behavior. *Psychological inquiry, 11*(4), 227-268.

714 Ryan, R. M., & Deci, E. L. (2008). Self-determination theory and the role of basic
715 psychological needs in personality and the organization of behavior. Handbook of
716 personality: Theory and research, 3, 654-678, New York, NY, US: The Guilford Press..

717 Ryan, R. M., & Deci, E. L. (2017). Self-determination theory: Basic psychological needs in
718 motivation, development, and wellness. Guilford Publications, New York.

719 Ryan, R. M., & Frederick, C. (1997). On energy, personality, and health: Subjective vitality as
720 a dynamic reflection of well-being. *Journal of Personality, 65*(3), 529-565.

721 Schinke, R. J., Stambulova, N. B., Si, G., & Moore, Z. (2018). International society of sport
722 psychology position stand: Athletes' mental health, performance, and development.
723 *International Journal of Sport and Exercise Psychology, 16*(6), 622-639.

724 Shannon, S., Brennan, D., Hanna, D., Younger, Z., Hassan, J., & Breslin, G. (2018). The
725 Effect of a School-Based Intervention on Physical Activity and Well-Being: a Non-
726 Randomised Controlled Trial with Children of Low Socio-Economic Status. *Sports*
727 *Medicine-Open, 4*(1), 16.

728 Shannon, S., Breslin, G., Haughey, T., Sarju, N., Neill, D., Lawlor, M., & Leavey, G. (2019).
729 Predicting Student-Athlete and Non-Athletes' Intentions to Self-Manage Mental Health:
730 Testing an Integrated Behaviour Change Model. *Mental Health & Prevention, 13,* 92-99.

731 SurveyMonkey, L. L. C. (2012). SurveyMonkey®. Palo Alto (CA): SurveyMonkey, LLC.

732 Vallerand, R. J. (2001). A hierarchical model of intrinsic and extrinsic motivation in sport and
733 exercise. Advances in motivation in sport and exercise, 2, 263-319.

Figure 1: Process variable-centred model informed by BPNT (Ryan & Deci, 2008) explaining the hypothesised positive and negative effects of the coach-led social environment on athletes' psychological needs satisfaction/frustration and positive and negative forms of functioning.

Note: + symbols refers to a hypothesised positive relationships; – symbols refers to hypothesised negative relationships; double headed arrows represent covariance pathways; single headed arrows represent hypothesised direct effects.

Figure 2: Standardised construct z-scores for IBQ variables amongst the 5 retained profiles with corresponding figurative labels

Table 1: Results of Latent Profile Analysis including model fit indices and comparisons

Model fit	1 Profile	2 Profiles	3 Profiles	4 Profiles	5 Profiles	6 Profiles
AIC	24516.062	23107.644	22525.770	22259.296	**22153.264**	22075.465
BIC	24570.415	23193.703	22643.535	22408.767	**22334.440**	22288.348
aBIC	24532.313	23133.375	22560.981	22303.987	**22207.435**	22139.116
Entropy	n/a	0.934	0.876	0.888	**0.904**	0.901
Vuong–LRT	n/a	0.0000*	0.0000*	0.2125	**0.0131***	0.3285
aLRT	n/a	0.0000*	0.0000*	0.2175	**0.0141***	0.3352
Profile Classification Probabilities	n/a	0.95, 0.99	0.92, 0.97, 0.95	0.95, 0.92, 0.92, 0.95	**0.93, 0.94, 0.95, 0.97, 0.91**	0.91, 0.92, 0.94, 0.93, 0.99, 0.86
Sample % for Profile(s)						
Profile 1	100%	18%	29%	54%	**28%**	6%
Profile 2	-	82%	14%	28%	**53%**	27%
Profile 3	-	-	57%	14%	**8%**	51%
Profile 4	-	-	-	4%	**4%**	8%
Profile 5	-	-	-	-	**7%**	2%
Profile 6	-	-	-	-	-	6%

Note: Bold highlighted row text indicates the best fitting model; * denotes statistical significance at $p < .05$; AIC= Akaike information criterion; BIC= Bayesian Information Criterion; aBIC= Sample Size Adjusted Bayesian Information Criterion; Vuong-LRT = p-value for Vuong–Lo–Mendell–Rubin Likelihood Ratio Test; aLRT= p-value for Adjusted Lo-Mendell-Rubin Likelihood Ratio Test; %=overall sample percentage for profile(s).

Table 2: Total mean scores for the retained profiles and full sample for subscales measured through the Interpersonal Behaviours Questionnaire (IBQ).

Variable subscale within the IBQ	**Sample**	**Profile 1** ***'Supportive developmental coach'***	**Profile 2** ***'Needs indifferent coach'***	**Profile 3** ***'Overly critical coach'***	**Profile 4** ***'Harsh controlling coach'***	**Profile 5** ***'Distant controlling coach'***
Autonomy-support	19.74 (4.510)	23.524 (0.294)	19.591 (0.185)	16.715 (0.783)	10.462 (1.207)	14.753 (0.637)
Autonomy-control	14.53 (4.953)	10.709 (0.421)	14.998 (0.240)	17.803 (0.669)	22.532 (0.718)	17.657 (0.757)
Competence-support	22.30 (4.458)	25.808 (0.219)	22.511 (0.159)	19.389 (0.693)	12.456 (1.051)	15.849 (1.081)
Competence-control	08.77 (4.668)	5.327 (0.182)	8.118 (0.146)	16.423 (0.766)	21.663 (0.883)	10.815 (0.902)
Relatedness-support	19.56 (5.078)	24.642 (0.279)	19.449 (0.184)	16.466 (0.463)	7.593 (0.578)	10.660 (0.731)
Relatedness-control	11.38 (4.961)	6.568 (0.237)	11.495 (0.194)	15.239 (0.603)	23.559 (0.782)	18.125 (0.587)

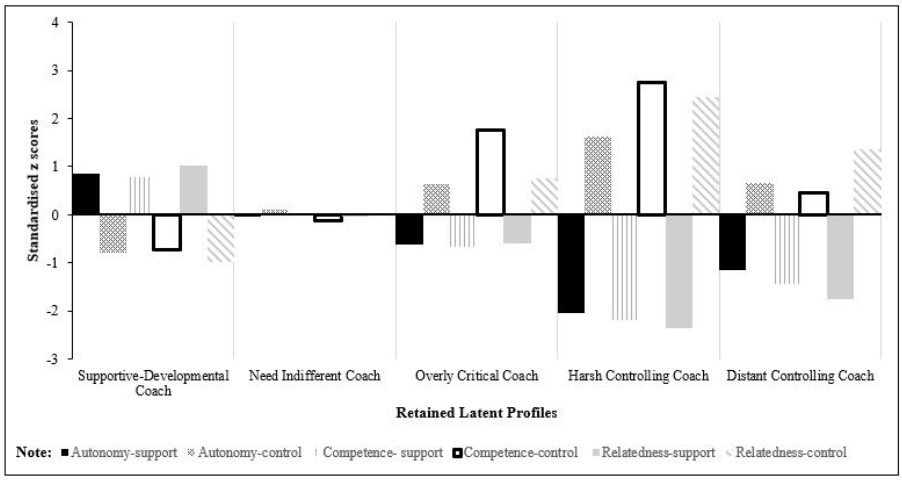
Note: Each scale includes 4 items scored on Likert scale of 1 to 7, and total scores range from a possible 4- 28, with 14 representing mid-point.

Table 3: Retained profile total mean scores and unstandardized total mean score comparisons through Bonferroni adjusted post-hoc comparisons.

Outcome variable	Profile 1 (Supportive-developmental coach)	Profile 2 (Need indifferent coach)	Profile 3 (Overly critical coach)	Profile 4 (Harsh controlling coach)	Profile 5 (Distant controlling coach)	Profile 1 vs 2	Profile 1 vs 3	Profile 1 vs 4	Profile 1 vs 5	Profile 2 vs 3	Profile 2 vs 4	Profile 2 vs 5	Profile 3 vs 4	Profile 3 vs 5	Profile 4 vs 5
Autonomy satisfaction	16.83 (2.74)	14.50 (2.50)	13.82 (2.78)	10.95 (3.52)	12.80 (2.73)	**2.33***	**3.01***	**5.88***	**4.03***	0.68	**3.55***	**1.70***	**2.87***	1.02	**-1.85***
Autonomy frustration	09.18 (4.05)	11.83 (2.64)	12.80 (2.81)	14.04 (3.46)	12.07 (2.90)	**-2.65***	**-3.62***	**-4.86***	**-3.52***	-0.97	**-2.21***	-0.87	-1.24	0.100	1.34
Competence satisfaction	16.15 (3.10)	14.51 (2.56)	13.39 (2.75)	14.37 (4.23)	13.53 (2.59)	**1.64***	**2.76***	**1.78***	**2.62***	1.12	0.14	0.98	-0.98	-0.14	0.84
Competence frustration	08.63 (4.28)	10.35 (3.33)	12.14 (3.08)	11.08 (4.03)	10.88 (3.93)	**-1.72***	**-3.51***	**-2.45***	**-2.25***	**-1.79***	-0.73	-0.53	1.06	1.26	0.20
Relatedness satisfaction	17.38 (2.95)	15.64 (2.61)	15.07 (3.13)	13.66 (4.29)	13.45 (3.73)	**1.74***	**2.31***	**3.72***	**3.93***	0.57	**1.98***	**2.19***	1.41	**1.62***	0.21
Relatedness frustration	06.92 (3.88)	08.92 (3.05)	10.55 (4.15)	11.93 (5.07)	10.06 (3.86)	**-2.00***	**-3.63***	**-5.01***	**-3.14***	**-1.63***	**-3.01***	-1.14	-1.38	0.49	1.87
Exhaustion	11.05 (3.61)	13.21 (3.44)	14.27 (3.06)	13.79 (3.7)	13.02 (3.61)	**-2.16***	**-3.22***	**-2.74***	**-1.97***	-1.06	-0.58	0.19	0.48	1.25	0.77
Accomplishment	11.74 (3.55)	13.62 (2.94)	15.31 (3.56)	16.39 (3.08)	15.71 (2.89)	**-1.88***	**-3.57***	**-4.65***	**-3.97***	**-1.69***	**-2.77***	**-2.09***	-1.08	-0.40	0.68
Devaluation	09.45 (3.69)	11.29 (3.95)	13.31 (4.44)	14.46 (4.76)	13.98 (3.76)	**-1.84***	**-3.86***	**-5.01***	**-4.53***	**-2.02***	**-3.17***	**-2.69***	-1.15	-0.67	0.48
Vitality	28.98 (4.24)	26.10 (3.92)	24.21 (4.38)	24.37 (5.26)	23.51 (5.11)	**2.88***	**4.77***	**4.61***	**5.47***	**1.89***	1.73	**2.59***	-0.16	0.70	0.86

Note: **bold numbers underlined with *** refer to statistically significant unstandarized mean differences; standard deviation scores are bracketed.

171x68mm (96 x 96 DPI)



228x119mm (96 x 96 DPI)

Supplementary Table 1: Fit Statistics for the CFA Models Tested on the Interpersonal Behaviours Questionnaire (IBQ) and the Need Satisfaction and Frustration Scale (NSFS)

Item	Factor	Factor loading
1	Competence frustration	0.82*
2	Competence frustration	0.91*
3	Competence frustration	0.84*
4	Competence satisfaction	0.74*
5	Competence satisfaction	0.86*
6	Competence satisfaction	0.86*
7	Relatedness satisfaction	0.81*
8	Relatedness satisfaction	0.90*
9	Relatedness satisfaction	0.70*
10	Relatedness frustration	0.90*
11	Relatedness frustration	0.83*
12	Relatedness frustration	0.75*
13	Autonomy	0.82*

Model	χ^2	df	CFI	TLI	RMSEA	GFI
IBQ						
Six correlated factors*	826.432	237	.955	.947	.061	.906
Unidimensional model	4258.990	252	.691	.661	.154	.583
NSFS						
Six correlated factors*	598.405	120	.926	.906	.076	.909
Unidimensional model	3550.736	135	.458	.386	.194	.564

Note: *= chosen as best fitting model for analyses

	satisfaction	
14	Autonomy satisfaction	0.79*
15	Autonomy satisfaction	0.55*
16	Autonomy frustration	0.63*
17	Autonomy frustration	0.64*
18	Autonomy frustration	0.76*

Supplementary Table 2: NSFS item numbers, factor descriptors and factor loadings

Note: *= statistically significant ($p < .05$).

Supplementary Table 3: Factor covariances for the 6-factor model of the NSFS scale

Covariance path	Covariance value
Competence frustration <> Competence satisfaction	-0.60*
Competence frustration <> Relatedness satisfaction	-0.36*
Competence frustration <> Relatedness frustration	-0.54*
Competence frustration <> Autonomy satisfaction	-0.32*
Competence frustration <> Autonomy frustration	0.28*
Competence satisfaction <> Relatedness satisfaction	0.42*
Competence satisfaction <> Relatedness frustration	-0.28*
Competence satisfaction <> Autonomy satisfaction	0.41*
Competence satisfaction <> Autonomy frustration	-0.09*
Relatedness satisfaction <> Relatedness frustration	-0.77*
Relatedness satisfaction <> Autonomy satisfaction	0.41*
Relatedness satisfaction <> Autonomy frustration	-0.14*
Relatedness frustration <> Autonomy satisfaction	-0.49*
Relatedness frustration <> Autonomy frustration	0.51*
Autonomy satisfaction <> Autonomy frustration	-0.43*

Note: *= statistically significant ($p < .05$).

Supplementary Table 4: Total mean scores and standard errors for needs-supportive and needs-controlling coach behaviours for a 2-profile solution.

Variable	Total Sample	Profile 1 *'Controlling coach'*	Profile 2 *'Needs-supportive coach'*
Autonomy support	19.74 (4.510)	14.225 (0.551)	20.978 (0.204)
Autonomy control	14.53 (4.953)	19.074 (0.461)	13.507 (0.245)
Competence support	22.30 (4.458)	16.024 (0.844)	23.706 (0.156)
Competence control	08.77 (4.668)	15.042 (0.845)	07.360 (0.171)
Relatedness support	19.56 (5.078)	12.252 (0.728)	21.193 (0.211)
Relatedness control	11.38 (4.961)	18.368 (0.712)	09.817 (0.207)

Supplementary Table 5: Total mean scores and standard errors for needs-supportive and needs-controlling coach behaviours for a 3-profile solution.

Variable	Sample	Profile 1 *'Supportive developmental coach'*	Profile 2 *'Controlling coach'*	Profile 3 *'Indifferent coach'*
Autonomy support	19.74 (4.510)	23.490 (0.299)	13.486 (0.589)	19.300 (0.181)
Autonomy control	14.53 (4.953)	10.774 (0.417)	19.216 (0.502)	15.347 (0.224)
Competence support	22.30 (4.458)	25.757 (0.226)	14.689 (0.545)	22.337 (0.174)
Competence control	08.77 (4.668)	5.444 (0.175)	15.886 (0.667)	8.776 (0.214)
Relatedness support	19.56 (5.078)	24.416 (0.263)	10.919 (0.625)	19.111 (0.191)
Relatedness control	11.38 (4.961)	6.772 (0.239)	19.380 (0.569)	11.852 (0.206)

Supplementary Table 6: Total mean scores and standard errors for needs-supportive and needs-controlling coach behaviours for a 4-profile solution.

Variable	Sample	Profile 1 *'Indifferent coach'*	Profile 2 *'Supportive developmental coach'*	Profile 3 *'Distant controlling coach'*	Profile 4 *'Harsh controlling coach'*
Autonomy support	19.74 (4.510)	19.592 (0.265)	23.575 (0.312)	15.481 (0.509)	10.084 (2.400)
Autonomy control	14.53 (4.953)	15.073 (0.310)	10.646 (0.434)	17.834 (0.629)	22.414 (1.244)
Competence support	22.30 (4.458)	22.641 (0.199)	25.829 (0.231)	16.850 (1.056)	12.247 (1.785)
Competence control	08.77 (4.668)	8.469 (0.239)	5.361 (0.177)	13.068 (0.935)	21.473 (2.465)
Relatedness support	19.56 (5.078)	19.470 (0.251)	24.608 (0.311)	13.360 (1.189)	7.384 (0.703)
Relatedness control	11.38 (4.961)	11.465 (0.276)	6.538 (0.269)	17.176 (0.900)	23.594 (1.177)

Supplementary Table 7: Total mean scores and standard errors for needs-supportive and needs-controlling coach behaviours for a 5-profile solution.

Variable	Sample	Profile 1 *'Supportive developmental coach'*	Profile 2 *'Need indifferent coach'*	Profile 3 *'Overly critical coach'*	Profile 4 *'Harsh controlling coach'*	Profile 5 *'Distant controlling coach'*
Autonomy support	19.74 (4.510)	23.524 (0.294)	19.591 (0.185)	16.715 (0.783)	10.462 (1.207)	14.753 (0.637)
Autonomy control	14.53 (4.953)	10.709 (0.421)	14.998 (0.240)	17.803 (0.669)	22.532 (0.718)	17.657 (0.757)
Competence support	22.30 (4.458)	25.808 (0.219)	22.511 (0.159)	19.389 (0.693)	12.456 (1.051)	15.849 (1.081)
Competence control	08.77 (4.668)	5.327 (0.182)	8.118 (0.146)	16.423 (0.766)	21.663 (0.883)	10.815 (0.902)
Relatedness support	19.56 (5.078)	24.642 (0.279)	19.449 (0.184)	16.466 (0.463)	7.593 (0.578)	10.660 (0.731)
Relatedness control	11.38 (4.961)	6.568 (0.237)	11.495 (0.194)	15.239 (0.603)	23.559 (0.782)	18.125 (0.587)

Supplementary Table 8: Total mean scores and standard deviations for needs-supportive and needs-controlling coach behaviours for a 6-profile solution.

Variable	Sample	Profile 1 *'Distant controlling coach'*	Profile 2 *'Supportive developmental coach'*	Profile 3 *'Indifferent coach'*	Profile 4 *'Overly critical coach'*	Profile 5 *'Harsh controlling coach'*	Profile 6 *'Apathetic coach'*
Autonomy support	19.74 (4.510)	13.650 (0.709)	23.576 (0.307)	19.716 (0.244)	16.906 (0.767)	7.020 (1.299)	16.470 (0.940)
Autonomy control	14.53 (4.953)	19.745 (0.627)	10.642 (0.439)	14.920 (0.315)	17.699 (0.694)	24.120 (1.258)	16.251 (1.925)
Competence support	22.30 (4.458)	14.624 (0.728)	25.867 (0.233)	22.680 (0.181)	19.472 (0.716)	9.546 (1.807)	18.342 (1.879)
Competence control	08.77 (4.668)	16.139 (0.903)	5.287 (0.190)	8.084 (0.152)	16.423 (0.705)	24.073 (1.037)	8.128 (0.535)
Relatedness support	19.56 (5.078)	9.754 (0.685)	24.730 (0.296)	19.699 (0.263)	16.705 (0.439)	5.947 (0.800)	12.884 (1.784)
Relatedness control	11.38 (4.961)	20.373 (0.609)	6.474 (0.258)	11.271 (0.278)	15.008 (0.606)	25.585 (1.055)	16.240 (0.837)

Supplementary Table 9: Descriptive statistics for the sample total mean score and standard deviations, further split by demographic and controlling factor groupings.

Variable	Sample	Males	Females	Elite	Semi-elite	Amateur	Recreational	Early-season	Mid-season	End-season	Pre-season	Off-season
Competence frustration	10.07 (3.87)	9.80 (3.74)	10.73* (4.10)	9.87 (4.38)	9.60 (3.89)	10.55* (3.82)	8.96 (3.65)	10.35 (3.82)	10.09 (3.81)	10.94 (4.23)	11.10 (5.10)	10.39 (4.28)
Competence satisfaction	14.80 (2.97)	14.93* (2.80)	14.49 (3.15)	15.55* (1.92)	15.34 (2.91)	14.45 (2.84)	15.28 (3.34)	14.68 (2.79)	14.89* (2.91)	13.26 (4.05)	14.00 (2.66)	13.58 (3.18)
Relatedness satisfaction	15.83 (3.14)	15.65 (3.12)	16.30 (3.14)	13.62 (4.06)	16.32 (2.89)	15.70 (3.17)	15.60 (3.28)	15.80 (3.27)	15.94 (2.98)	15.32 (4.51)	16.20 (2.78)	15.21 (3.15)
Relatedness frustration	8.69 (3.78)	8.88 (3.71)	8.22 (3.92)	9.25 (4.06)	9.06 (3.69)	8.77 (3.74)	7.62 (3.92)	8.66 (3.63)	8.95 (3.81)	9.59 (4.42)	6.60 (3.23)	10.11 (4.14)
Autonomy satisfaction	14.82 (3.04)	14.82 (3.01)	14.84 (3.13)	12.87 (2.41)	14.69 (2.77)	14.49 (3.06)	16.47 (2.94)	14.64 (3.06)	14.51 (2.99)	13.93 (2.64)	15.40 (2.11)	15.03 (2.20)
Autonomy frustration	11.31 (3.62)	11.59 (3.51)	10.62 (3.81)	12.50 (4.53)	11.92 (3.26)	11.77 (3.36)	8.18 (3.78)	11.32 (3.24)	12.18 (3.35)	13.35 (3.56)	9.30 (4.24)	11.36 (2.92)
Subjective vitality	26.49 (4.55)	26.15 (4.52)	27.32* (4.53)	21.25 (6.56)	26.41 (4.21)	26.18 (4.60)	28.18 (4.34)	26.84 (4.02)	25.76 (4.79)	26.07 (4.22)	28.70* (4.25)	24.98 (4.98)
Emotional & physical exhaustion	2.54 (0.74)	2.60 (0.70)	2.38 (0.79)	3.45* (0.46)	2.80 (0.73)	2.52 (0.69)	2.08 (0.65)	2.53 (0.71)	2.71 (0.71)	2.46 (0.73)	2.34 (0.38)	2.29 (0.82)
Reduced accomplishment	2.69 (0.69)	2.75 (0.69)	2.55 (0.67)	2.57 (0.40)	2.63 (0.64)	2.85* (0.65)	2.16 (0.68)	2.77 (0.64)	2.79 (0.66)	2.75 (0.75)	2.88 0(.34)	2.75 (0.68)
Sport devaluation	2.25 (0.84)	2.31 (0.85)	2.08 (0.79)	2.42* (1.02)	2.09 (0.73)	2.38 (0.88)	1.99 (0.76)	2.20 (0.85)	2.37 (0.83)	2.25 (0.93)	2.22 (0.79)	2.28 (0.91)

Note: * denotes a statistically significance difference between that group to the remaining groups at $p < .05$; standard deviation scores are bracketed.

Supplementary Table 9 Summary

Supplementary Table 9 shows that males scored significantly higher than females on competence satisfaction, but the effect size was small (η_p^2 = .02); whereas females scored significantly higher than males on competence frustration and vitality, again with small effects (ηp^2= .02, and .01). Level of participation was a significant predictor of the three burnout dimensions, such that, in a linear manner, elite athletes scored the highest on emotional and physical exhaustion in comparison to semi-elite, amateur and recreational athletes (ηp2= .06). Elite athletes also scored the highest on sport devaluation, (ηp^2= .01) and competence satisfaction (ηp^2= .03). Amateur athletes scored the highest in reduced accomplishment (ηp^2= .01) and competence frustration (ηp^2= .01). Lastly, seasonal stage revealed significant multivariate effects for competence satisfaction (ηp^2= .01) and subjective vitality (ηp^2= .01).

Table 10: Correlation Matrix of the Study Variables

Autonomy support	**1**															
Autonomy control	-.586**	**1**														
Competence support	.568**	-.362**	**1**													
Competence control	-.526**	.500**	-.600**	**1**												
Relatedness support	.655**	-.465**	.712**	-.593**	**1**											
Releatedness control	-.591**	.516**	-.641**	.622**	-.781**	**1**										
Competence frustration	-.185**	.185**	-.155**	.243**	-.245**	.272**	**1**									
Competence satisfaction	.242**	-.090**	.262**	-.243**	.282**	-.219**	-.561**	**1**								
Releatedness satisfaction	.321**	-.120**	.336**	-.241**	.384**	-.346**	-.270**	.458**	**1**							
Releatedness frustration	-.273**	.290**	-.254**	.308**	-.340**	.376**	.322**	-.247**	-.518**	**1**						
Autonomy satisfaction	.506**	-.403**	.380**	-.338**	.453**	-.431**	-.249**	.336**	.351**	-.343**	**1**					
Autonomy frustration	-.329**	.439**	-.273**	.290**	-.337**	.372**	.216**	-.112**	-.116**	.343**	-.465**	**1**				
Exhastion	-.200**	.245**	-.161**	.217**	-.209**	.279**	.265**	-.182**	-.159**	.275**	-.231**	.274**	**1**			
Accomplishment	-.332**	.279**	-.382**	.351**	-.380**	.360**	.434**	-.481**	-.294**	.303**	-.314**	.294**	.400**	**1**		
Devaluation	-.296**	.249**	-.373**	.330**	-.326**	.328**	.253**	-.279**	-.297**	.214**	-.288**	.222**	.429**	.576**	**1**	
Subjective vitality	.293**	-.210**	.390**	-.281**	.342**	-.329**	-.269**	.342**	.368**	-.275**	.380**	-.284**	-.335**	-.386**	-.406**	**1**

Note: ** Correlation is significant at the 0.01 level